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मानक

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IS/IEC 61558-2-7 (2007): Safety of power transformers, power supplies reactors and similar products, Part 2-7 Particular requirements and tests for transformers and power supplies for toys, [ETD 16: Transformers]



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Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”

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भारतीय मानक

पॉवर ट्रांसफार्मरों, पॉवर आपूर्ति इकाइयों और ऐसी इकाइयों की सुरक्षा

भाग 2-7 खिलौनों के लिए ट्रांसफार्मर तथा पॉवर आपूर्ति की विशेष अपेक्षाएँ और परीक्षण

Indian Standard

**SAFETY OF POWER TRANSFORMERS, POWER
SUPPLIES REACTORS AND SIMILAR PRODUCTS**

**PART 2-7 PARTICULAR REQUIREMENTS AND TESTS FOR TRANSFORMERS
AND POWER SUPPLIES FOR TOYS**

ICS 29.180

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

August 2011

Price Group 7

NATIONAL FOREWORD

This Indian Standard (Part 2-7) which is identical with IEC 61558-2-7 : 2007 'Safety of power transformers, power supplies reactors and similar products — Part 2-7: Particular requirements and tests for transformers and power supplies for toys' issued by the International Electrotechnical Commission (IEC) was adopted by the Bureau of Indian Standards on the recommendation of the Transformers Sectional Committee and approval of the Electrotechnical Division Council.

This standard is to be read in conjunction with IS/IEC 61558-1 : 2005 'Safety of power transformer, power supply units and similar: Part 1 General requirements and tests'.

The text of IEC Standard has been approved as suitable for publication as an Indian Standard without deviations. Certain terminology and conventions are, however, not identical to those used in Indian Standards. Attention is particularly drawn to the following:

- a) Wherever the words 'International Standard' appear referring to this standard, they should be read as 'Indian Standard'.
- b) Comma (,) has been used as a decimal marker while in Indian Standards, the current practice is to use a point (.) as the decimal marker.

<i>International Standard</i>	<i>Corresponding Indian Standard</i>	<i>Degree of Equivalence</i>
IEC 60227-1 : 1979 Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V — Part 1: General requirements	IS 694 : 1990 PVC Insulated cables for working voltages upto and including 1 100 V (<i>third revision</i>)	Technically Equivalent
IEC 60245-1 Rubber insulated cables — Rated voltages up to and including 450/750 V — Part 1: General requirements	IS 9968 (Part 1) : 1988 Elastomer insulated cables: Part 1 For working voltages upto and including 1 100 V (<i>first revision</i>)	do

Only the English language text of the International Standard has been retained while adopting it in this Indian Standard, and as such the page numbers given here are not the same as in the IEC Standard.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

*Indian Standard*SAFETY OF POWER TRANSFORMERS, POWER
SUPPLIES REACTORS AND SIMILAR PRODUCTSPART 2-7 PARTICULAR REQUIREMENTS AND TESTS FOR TRANSFORMERS
AND POWER SUPPLIES FOR TOYS**1 Scope***Replacement:*

This part of IEC 61558 deals with safety aspects of **transformers for toys** and **power supplies** incorporating **transformers for toys** such as electrical, thermal and mechanical safety.

This Part 2-7 is applicable to **transformers for toys** and **power supplies** incorporating both **transformers for toys** and **electronic circuits**. This Part 2-7 is not applicable to external circuits and their components intended to be connected to the input terminals, output terminals or socket-outlets of the **transformers** and **power supplies**.

This Part 2-7 applies to **stationary** and **portable**, single-phase, air-cooled (natural or forced), **transformers for toys** and **power supplies** incorporating **transformers for toys**, having a **rated supply voltage** not exceeding 250 V a.c., a **rated supply and internal operating frequency** not exceeding 500 Hz, a **rated output** not exceeding 200 VA and a **rated output current** not exceeding 10 A.

This Part 2-7 is applicable to **independent transformers** and **transformers for specific use**.

This Part 2-7 is applicable to **dry-type transformers for toys**. The windings may be encapsulated or non-encapsulated.

The **no-load output voltage** does not exceed 33 V a.c. for **transformers for toys** and **power supplies** incorporating **transformers for toys**, or 46 V ripple-free d.c. for **power supplies** incorporating **transformers for toys**, and the **rated output voltage** does not exceed 24 V a.c. for **transformers** and **power supplies**, or 33 V ripple-free d.c. for **power supplies**.

In general, this Part 2-7 does not take into consideration children playing with the **transformers for toys** and **power supplies** incorporating **transformers for toys**.

NOTE 1 Attention is drawn to the following:

- for **transformers for toys** and **power supplies** incorporating **transformers for toys** intended to be used in vehicles, on board ships, and aircraft, additional requirements (from other applicable standards, national rules, etc.) may be necessary;
- measures to protect the **enclosure** and the components inside the enclosure against external influences such as fungus, vermin, termites, solar-radiation, and icing should also be considered;
- the different conditions for transportation, storage, and operation of the **transformers for toys** and **power supplies** incorporating **transformers for toys** should also be considered;

- additional requirements in accordance with other appropriate standards and national rules may be applicable to **transformers for toys** and **power supplies** incorporating **transformers for toys** intended for use in special environments, such as tropical environments.

NOTE 2 Future technological development of **transformers** and **power supplies** may necessitate a need to increase the upper limit of the frequencies; until then, this Part 2-7 may be used as a guidance document.

2 Normative references

This clause of Part 1 is applicable except as follows:

Addition:

IEC 60227-1, *Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V – Part 1: General requirements*

IEC 60245-1, *Rubber insulated cables – Rated voltages up to and including 450/750 V – Part 1: General requirements*

3 Terms and definitions

This clause of Part 1 is applicable except as follows:

Replacement of the third paragraph:

When the term **transformer** is used from here forward, it covers **transformers for toys** and **power supplies** incorporating **transformers for toys where applicable**.

Addition:

3.1.101

transformer for toys

independent safety isolating transformer designed to supply toys not fixed to, or incorporated in, toys and having a **rated output voltage** not exceeding 24 V a.c.

3.1.102

power supply for toys

power supply incorporating a **transformer for toys** not fixed to, or incorporated in, toys and having a **rated output voltage** not exceeding 24 V a.c. or 33 V ripple-free d.c.

4 General requirements

This clause of Part 1 is applicable.

5 General notes on tests

This clause of Part 1 is applicable.

6 Ratings

Replacement:

6.101 The **rated output voltage** shall not exceed 24 V a.c for **transformers** and **power supplies** or 33 V ripple-free d.c. for **power supplies**.

6.102 The **rated output** shall not exceed 200 VA.

6.103 The **rated supply frequency** shall not exceed 500 Hz.

6.104 There shall be only one **rated supply voltage** not exceeding 250 V a.c.

6.105 The **rated output current** shall not exceed 10 A.

Compliance with the requirements of 6.101 to 6.105 is checked by inspection of the marking.

7 Classification

This clause of Part 1 is applicable except as follows:

7.1 *Replacement:*

According to their protection against electric shock:

- **transformers** shall be of class II construction.

7.2 *Replacement:*

According to short-circuit protection or protection against abnormal conditions:

- **inherently short-circuit-proof transformers;**
- **non-inherently short-circuit-proof transformers;**
- **fail-safe transformers.**

7.4 *Replacement:*

According to their mobility:

- **portable transformers;**
- **stationary transformers.**

7.5 *Replacement:*

According to their duty-type:

- **continuous operation.**

8 Marking and other information

This clause of Part 1 is applicable except as follows:

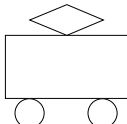
8.1 Item h) *Addition:*

Transformers for toys shall be marked with one of the graphical symbols shown in 8.11;

8.1 Item n) *Modification:*

transformers suitable for outdoor use shall be marked with the appropriate IP code;

8.11 *Addition:*

Symbol or graphical symbol	Explanation or title	Identification
	Transformers for toys (inherently short-circuit-proof transformers, non-inherently short-circuit-proof transformers or fail-safe transformers)	IEC 60417-5219 (2002-10)

8.101 The INSTRUCTION FOR USE shall include the following statement or equivalent:

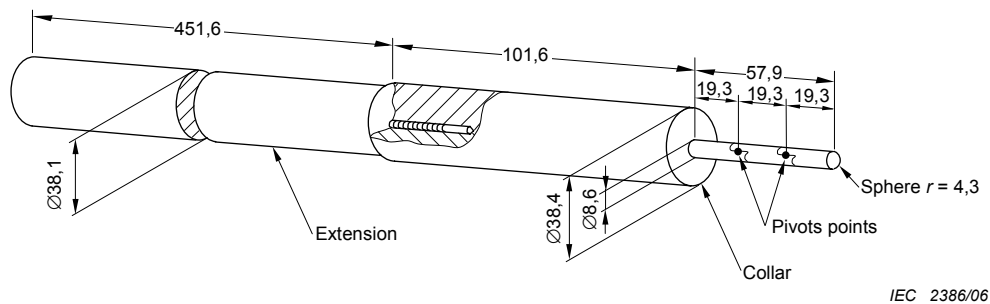
Instructions to parents: "Transformers and power supplies for toys are not intended to be used as toys, and the use of these products by children shall be under the full supervision of parents."

9 Protection against electric shock

This clause of Part 1 is applicable except as follows:

9.1.2 *Modification:*

The standard test finger of Figure 2 is replaced by the small test finger of Figure 101.



Matière: métal

Dimensions en millimètres

Tolérances sur les dimensions $\pm 0,125$ mm

Les deux articulations doivent permettre un mouvement, dans le même sens, de 90° avec une tolérance de 0° à $+10^\circ$

Material: metal

Dimensions in millimetres

Tolerances on dimensions $\pm 0,125$ mm

Both joints shall permit movement in the same plane and the same direction through an angle of 90° with a 0° to $+10^\circ$ tolerance

Figure 101 – Small test finger

9.1.2 Addition:

It shall not be possible to gain access to **live parts** of the **input circuit** or to the metal parts separated from live parts by **basic insulation** only, even after removal of the covers that can be removed with the aid of a tool.

10 Change of input voltage setting

This clause of Part 1 is applicable except as follows:

Replacement:

Transformers shall have only one **rated supply voltage** or one **rated supply voltage range**.

Compliance is checked by inspection.

11 Output voltage and output current under load

This clause of Part 1 is applicable except as follows:

11.1 Modification:

When the **transformer** is connected to the **rated supply voltage**, at the **rated supply frequency** and loaded with an impedance resulting in the **rated output** at the **rated output voltage** and, for an a.c. rated power factor, the **output voltage** shall not differ from the rated value by more than 10 % for a.c. or 15 % for d.c.

This requirement is applicable to all the **output windings** and their tapings.

12 No-load output voltage

This clause of Part 1 is applicable except as follows:

Addition:

12.101 The **no-load output voltage** shall not exceed 33 V a.c. or 46 V ripple-free d.c. For toy transformers, this output voltage limitation applies even when **output windings** not intended for interconnection are connected in series.

12.102 The difference between the **no-load output voltage** and the output voltage under load shall not be excessive.

*Compliance with the requirements of 12.101 and 12.102 is checked by measuring the **no-load output voltage** at the ambient temperature, and the **transformer** is connected to the **rated supply voltage** at the **rated supply frequency**.*

The difference between the **no-load output voltage** measured in this clause and the output voltage under load measured during the test of Clause 11, expressed as a percentage of the latter voltage, shall not exceed 100 %.

NOTE The ratio is defined as follows:

$$\frac{U_{\text{no-load}} - U_{\text{load}}}{U_{\text{load}}} \times 100 (\%)$$

where $U_{\text{no-load}}$ is the no-load output voltage and U_{load} is the output voltage under load.

13 Short-circuit voltage

This clause of Part 1 is not applicable.

14 Heating

This clause of Part 1 is applicable except as follows:

Table 1

Modification:

*Replace all the requirements for external **enclosures** by the following:*

Parts	Temperature °C
External enclosures which can be touched with the small test finger of Figure 101), handles and the like, if made of	
♦ metal;	50
♦ other material.	60
External enclosures (which cannot be touched with the small test finger of Figure 101).	85

15 Short-circuit and overload protection

This clause of Part 1 is applicable except as follows:

15.1 Addition:

Transformers shall be of either **short-circuit-proof** or **fail-safe** construction. **Short-circuit-proof transformers** shall withstand overloads that may occur during normal use. They shall not incorporate fuses.

If the short-circuit output current exceeds 20 A, a non-self-resetting overload protective device shall be incorporated.

Non-self-resetting overload protective devices, if any, shall be incorporated in the **input circuit**.

Table 3

Replace the requirements for external **enclosures** by the following:

Parts	Maximum temperature °C
External enclosures (which may be touched with the small test finger of Figure 101):	
♦ made of metal;	50
♦ made of other material.	60

Addition:

15.3.101 The **input circuit** of the **transformer** having a short-circuit current exceeding 20 A shall be connected to the **rated supply voltage** in the cold condition (i.e., as received and in the normal room ambient), and each **output circuit** or winding shall be short-circuited, one at a time, while the other windings or **output circuits** are open-circuited.

Only the output circuits with a short-circuit current exceeding 20 A shall be short-circuited in the case of more than one output current.

The overload protective device shall operate within 1 s.

15.5.2 Modification of the first dash as follows:

- the temperature of any part of the **enclosure** of the **fail-safe transformer** that may be touched with the small test finger of Figure 101 shall not exceed
 - 50 °C if made of metal;
 - 60 °C if made of other material.

16 Mechanical strength

This clause of Part 1 is applicable except as follows:

16.1 Replacement of the second paragraph as follows:

Compliance is checked by the test of 16.2 for **stationary transformers** and by the tests of 16.2, 16.3, 16.4, and 16.101, as appropriate, for **portable transformers**.

Addition:

16.101 In addition, **transformers** are subjected to the following test:

The **transformer** is dropped against a steel bar mounted on a solid wall of brick, stone, concrete or the like, as shown in Figure 102.

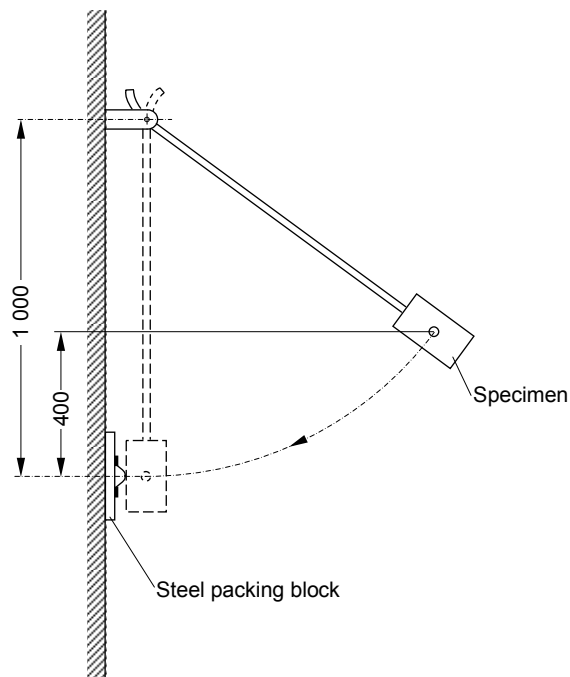


**Figure 102 – Arrangement for impact test for transformers
(see 16.101)**

The bar is of 40 mm × 40 mm × 5 mm right-angle section with the corner rounded to a radius of 5 mm. It is mounted in contact with the wall, or, if necessary, in contact with a steel packing block which is in contact with the wall.

The **transformer** is suspended by its flexible cable or cord so that it rests against the corner of the bar, the point of suspension being 1 m above the bar. It is then drawn away from the bar in a plane perpendicular to the wall until it has risen through a height of 40 cm.

The **transformer** is allowed to fall against the bar. For **transformers** shaped as a cube or parallelogram, one blow is applied to each of the six sides of the **transformer**; for **transformers** shaped differently, one blow is applied to each similarly exposed side.

The steel packing block is only necessary if the shape of the **transformer** is such that, without it, the **transformer** does not hit the bar.

*In addition, the **transformer** is allowed to fall freely from a height of 40 cm onto a steel plate, at least 5 mm thick, placed on a flat concrete base.*

*The number of falls is 10 times with the **transformer** cable mounted as in normal use, and the orientation of the **transformer** is different for each fall.*

*After the test, the **transformer** shall show no damage within the meaning of this standard. In particular, live parts shall not become accessible.*

17 Protection against harmful ingress of dust, solid objects and moisture

This clause of Part 1 is applicable.

18 Insulation resistance, dielectric strength and leakage current

This clause of Part 1 is applicable.

19 Construction

This clause of Part 1 is applicable except as follows:

Replacement of 19.1:

19.1 The **input** and **output circuits** shall be electrically separated from each other and the construction shall be such that there is no possibility of any connection between these circuits, either directly or indirectly, via other metal parts, except by deliberate action.

Compliance is checked by inspection and measurements, taking Clauses 18 and 26 into consideration.

19.1.1 The **insulation** between the **input** and **output winding(s)** shall consist of **double** or **reinforced insulation**. In addition, the **insulation** between the **input windings** and the **body**, and between the **output windings** and the **body** shall consist of **double** or **reinforced insulation**.

19.1.2 For **transformers** with **intermediate conductive parts** (for example, the iron core), not connected to the **body** and located between the **input** and **output windings**, the **insulation** between the **intermediate conductive part** and the **input windings** or between the **intermediate conductive part** and the **output windings** shall consist of at least **basic insulation**.

NOTE An **intermediate conductive part**, not separated from the **input** or **output windings** or the **body** by at least **basic insulation**, is considered to be connected to the relevant part(s).

In addition, the **insulation** between the **input** and **output windings**, via the **intermediate conductive part**, shall consist of **double** or **reinforced insulation**; the **insulation** between the **input windings** and the **body**, and between the **output windings** and the **body**, via the **intermediate conductive part**, shall consist of **double** or **reinforced insulation**.

19.16 *Addition:*

Transformers shall comply with the requirements for protection code IP4X or higher with the exception of output terminals.

Transformers for outdoor use shall have a protection code of IP65/IP67 or higher.

Compliance is checked by the tests of Clause 17.

Addition:

19.101 There shall be no connections between the **output circuit** and the protective earth.

19.102 There shall be no connections between the **output circuit** and the **body**.

Compliance is checked by inspection.

19.103 The input and output terminals for the connection of external wiring shall be so located that the distance measured between the points of introduction of the conductors into these terminals is not less than 25 mm. If a barrier is used to obtain this distance, the measurement shall be made over and around the barrier and it shall be of insulating material and be permanently fixed to the **transformer**.

*Compliance is checked by inspection and by measurement disregarding **intermediate conductive parts**.*

19.107 **Transformers** shall be of class II.

19.108 **Transformers** shall not be fixed to or incorporated in toys.

Compliance is checked by inspection.

19.111 **Transformers** with a.c. terminals in the **output circuit** shall be designed such that when

- the **output circuits** of two or more **transformers** are connected together, and
- the **input circuit** of at least one of the **transformers** is connected to the mains supply, and
- the **input circuit** of at least one of the **transformers** is not connected to the mains supply,

the voltage across the bare pins of the plug of the **transformers** not connected to the mains supply shall not exceed 33 V a.c.

*Compliance is checked by measurement of the voltage between the pins of the plug when the **output circuit** is supplied by the **rated output voltage(s)**.*

20 Components

This clause of Part 1 is applicable except as follows:

20.4 *Addition:*

Transformers shall not be provided with switches connected to the flexible supply cables or cords.

20.5 *Addition:*

It shall not be possible to make permanent contact with any of the pins of the plugs accepted by socket-outlets in the **output circuit** of the **transformer** and connectors of **appliance couplers** according to IEC 60320.

Compliance is checked by inspection.

20.7.1 *Modification:*

For **non-self-resetting thermal cut-outs** and **non-self-resetting** overload protective devices, the number of cycles of operation is increased from 300 to 1 000.

Addition:

20.101 It shall be possible to reset the **non-self-resetting thermal cut-outs** and **non-self-resetting** overload protective devices without removing their covers.

*Compliance is checked by short-circuiting the output terminals and connecting the **transformer** to the **rated supply voltage** until the device operates. If more than one set of output terminals are provided, each set shall be tested separately.*

*It shall not be possible to maintain the **thermal cut-out** or the overload protective device in the "ON" position by operating the resetting means.*

After removal of the short circuit, it shall be possible to put the overload protective device in the "ON" position without removing any covers. If necessary, after cooling.

20.102 Control devices, if any, shall be in the **output circuit** and shall operate reliably.

Compliance is checked by inspection and by the following test:

*The control is operated 5 000 times. Each time from one extreme end of the range to the other at a uniform rate of approximately 30 cycles per minute with the **transformer** connected to the **rated supply voltage** and loaded with the **rated output current** at unity power factor. During this test, no interruption of the current shall occur. After the test, the temperatures of the **transformer** windings shall not exceed the values specified in 14.2, and the no-load input current shall not alter by a short-circuit placed between the turns of the windings of the **output circuit**.*

20.103 The operating means of control devices, if any, shall not be affixed to the **transformers** with the exception of **transformers** for toy railway applications.

NOTE: In Denmark the exception of clause 20.103 is not applicable.

21 Internal wiring

This clause of Part 1 is applicable.

22 Supply connection and other external flexible cables or cords

This clause of Part 1 is applicable except as follows:

22.5 *Modification:*

Power supply cords of transformers complying with the requirements for protection code IP4X shall not be lighter than ordinary tough rubber sheathed cord (code designation 60245 IEC 53 of IEC 60245-1) or ordinary polyvinyl chloride sheathed flexible cord (code designation 60227 IEC 53 of IEC 60227-1).

Power supply cords of transformers with the protection code of IP67 shall not be lighter than ordinary polychloroprene sheathed cord (code designation 60245 IEC 57 of IEC 60245-1).

22.6 *Replacement:*

Appliance couplers are not allowed in the **input circuits of transformers**.

22.7 *Modification:*

For **transformers** having a mass greater than 500 g excluding the cable or cord, the cross-sectional area of the supply cable or cord shall be at least 1 mm².

22.9 *Modification:*

Power supply cords may be connected to the **transformers** by **type Y** and **type Z attachments**. **Type X attachment** is not allowed.

23 Terminals for external conductors

This clause of Part 1 is applicable.

24 Provisions for protective earthing

This clause of Part 1 is not applicable.

25 Screws and connections

This clause of Part 1 is applicable.

26 Creepage distances, clearances, and distances through insulation

This clause of Part 1 is applicable.

27 Resistance to heat, abnormal heat, fire and tracking

This clause of Part 1 is applicable.

28 Resistance to rusting

This clause of Part 1 is applicable.

Annexes

The annexes of Part 1 are applicable.

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Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Catalogue' and 'Standards: Monthly Additions'.

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Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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